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LEAD CONCENTRATIONS IN SURFACE SOIL FROM PRIVATE
RESIDENTIAL PROPERTIES AND PUBLICLY-ACCESSIBLE LOCATIONS
IN THE VICINITY OF TORONTO REFINERS AND SMELTERS,
NOVEMBER, 1986. 1987.

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Ministry of the Environment

The Honourable
Jim Bradley
Minister

Rod McLeod
Deputy Minister

Lead Concentrations in Surface Soil from Private Residential Properties and Publicly-Accessible Locations in the Vicinity of Toronto Refiners and Smelters - November, 1986

Phytotoxicology Section
Air Resources Branch

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Introduction

In November of 1986, staff of the Phytotoxicology Section collected surface soil samples from 27 private residential properties (Figure 1) and 17 publicly-accessible locations (Figure 2) in the vicinity of Toronto Refiners and Smelters (TRS). The residential sampling was requested by area residents who were concerned that lead emissions from TRS had contaminated the soil on their properties. The sampling at publicly-accessible locations was requested by officials of the Toronto Department of Public Health, who were concerned that high lead levels may represent a danger to the health of young children playing at these locations.

Methods

Duplicate samples, each consisting of a minimum of 10 soil cores of 0-5 cm depth, normally were collected at each sampling site using a stainless steel soil corer. Gardens were sampled at usual tilled depth (0-15 cm). Where excessively hard-packed conditions or loose, coarse or sandy material were encountered, samples of approximately 0-2 cm in depth were collected using a trowel. The samples were processed in the Phytotoxicology laboratory and were analyzed for lead by the MOE Laboratory Services Branch.

Results

Residential Properties

The analytical results of the residential property sampling are shown in Table 1. Of the 27 residential properties sampled, 22 (81.5%) had one or more sampling sites with "above-normal" (greater than 500 ug/g (ppm)) lead concentration in soil. The total number of residential sites (front lawns, back lawns, gardens, car parking areas) with greater than 500 ug/g lead was 29 (61.7% of the 47 residential sites sampled).

Eight of 27 properties (9 of 47 sites) had more than 1000 ug/g lead in soil. The highest soil lead level measured was 4450 ug/g, in a backyard garden along Niagara Street. This was the only residential result to exceed the former soil replacement level of 2600 ug/g (this location was not sampled previously and soil had not been replaced in 1976-77).

Table 2 compares the present residential property results with results of soil sampling conducted by the Phytotoxicology Section in 1976. For 22 sites (17 properties) for which directly comparable data exist (i.e. same sampling depth and no known soil replacement), the average soil lead level decreased by 118 ug/g, from 670 to 552 ug/g, a 17.6% decrease. Measured soil lead levels decreased on 16 of the 22 sites, and increased on 6 sites. The largest change was an increase of 866 ug/g in measured lead levels in a backyard on Niagara Street, near the north TRS property line.

Publicly-Accessible Locations

Results of the analyses of samples collected from 17 publicly-accessible locations near TRS are given in Table 3 and are illustrated in Figure 3. Lead concentrations (average of duplicate samples) ranged from a low of 82 ug/g on a parking lot (Station 10) located 200 m NW of Toronto Refiners & Smelters to a high of 20,000 ug/g between unused railway tracks crossing a parking area in the northwest angle of the TRS property.

From Figure 3, it can be seen that all nine stations located south of Niagara Street (i.e. within approximately 100 m of TRS) had more than 1000 ug/g soil lead, whereas all eight stations location north of Niagara Street had less than 1000 ug/g soil lead (maximum 760 ug/g). Five of these eight stations had more than 500 ug/g lead, the Phytotoxicology Section "upper limit of normal" lead level in urban surface soil.

Summary

Twenty-two of 27 residential properties sampled near Toronto Refiners & Smelters in November, 1986 had one or more sites with above-normal soil lead levels (>500 ug/g). Eight of the 27 properties revealed soil lead levels of greater than 1000 ug/g. A high level of 4450 ug/g soil lead was found in a backyard garden along Niagara Street.

Surface soil at nine publicly-accessible locations south of Niagara Street (within 100 m of TRS) had >1000 ug/g lead, while eight locations north of Niagara Street had <1000 ug/g lead. Five of eight locations north of Niagara Street had >500 ug/g lead, the Phytotoxicology Section "upper limit of normal" for urban surface soil.

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TABLE 1 - Lead concentrations (ppm or µg/g, dry weight) in surface soil* samples collected from residential properties in the vicinity of Toronto Refiners & Smelters - November, 1986

Street	AVERAGE RESULTS Front Yard	Back Yard	Replicate Results	
Niagara St.	Lawn 930	Garden 610	(880 & 980)	(620 & 600)
Niagara St.	Lawn 425	N/A	(410 & 440)	
Niagara St.	Lawn 350	Garden 4450	(350 & 350)	(4600 & 4300)
Niagara St.	Lawn 245	Garden 1600	(280 & 210)	(1400 & 1800)
Niagara St.	Lawn 225	N/A	(230 & 220)	
Niagara St.	Lawn 430	Side of house 790	(410 & 450)	(860 & 720)
Niagara St.	Lawn 495	Lawn 735	(550 & 440)	(730 & 740)
Niagara St.	Lawn 260	Bare area 960	(330 & 190)	(930 & 990)
Niagara St.	Lawn 500	Lawn 2400	(430 & 570)	(2400 & 2400)
Niagara St.	(Paved)	Garden 770		(850 & 690)
Niagara St.	Lawn 1200	Lawn 1300	(1200 & 1200)	(1300 & 1300)
Niagara St.	Lawn 565	N/A	(580 & 550)	
Niagara St.	Lawn 250	Lawn 315	(250 & 250)	(370 & 260)
Niagara St.	Lawn 400 Garden 640	(Paved)	(440 & 360) (670 & 610)	
Tecumseth St.	Lawn 410	Garden 1050	(440 & 380)	(1000 & 1100)
Tecumseth St.	Lawn 545	Lawn 610	(490 & 590)	(610 & 610)
Wellington St.W	Lawn 820	Lawn 680	(820 & 820)	(700 & 660)
Wellington St.W	Lawn 280	Lawn 575	(260 & 300)	(570 & 560)
Wellington St.W	Lawn 495	Lawn 815	(480 & 510)	(850 & 780)
Wellington St.W	(Paved)	Lawn 260		(230 & 290)
Wellington St.W	(Paved)	Garden 48 Parking Area**160	(single sample) (single sample)	
Wellington St.W	Bare area 405	Lawn 610	(390 & 420)	(560 & 660)
Wellington St.W	Lawn 535	Lawn 1145 Garden 730	(540 & 530) (single sample)	(1300 & 990)
Wellington St.W	Lawn 505	Garden 380	(490 & 520)	(490 & 270)
Bathurst St.	(Paved)	Parking area**780	(single sample)	
Bathurst St.	(Paved)	Parking area**1300	(single sample)	
Bathurst St.	(Paved)	Parking area**2300	(single sample)	

Note: Phytotoxicology Section "upper limit of normal" lead concentration in urban surface soil (0-5 cm depth) is 500 µg/g.

N/A - no access to yard
* - Sampling depth was 0-5 cm for lawns, 0-15 cm for gardens
** - 0-2 cm sampling depth

TABLE 2 - Lead concentrations (ppm or µg/g, dry weight) in surface soil (0-5 cm depth) on residential properties near Toronto Refiners & Smelters sampled in 1976 and again in 1986

Sampling Location		1976	1986	Change
Niagara St.	- front	544	930	+386
	- back	(306)	(610)***	-
Niagara St.	- front	1280	425	-855
Niagara St.	- front	(3340)*	(350)	-
Niagara St.	- front	303	245	-58
	- back	734	1600	+866
Niagara St.	- front	200	225	+25
Niagara St.	- front	433	430	-3
Niagara St.	- back	508	735	+227
Niagara St.	- front	(2030)	(260)**	-
	- back	720	960	+240
Niagara St.	- front	(2790)*	(500)	-
	- back	(7810)*	(2400)	-
Niagara St.	- back	(11500)*	(770)***	-
Niagara St.	- front	1090	565	-525
Niagara St.	- front	926	250	-676
	- back	958	315	-643
Niagara St.	- front	791	400	-391
Tecumseth St.	- front	700	410	-290
	- back	(2080)	(1050)***	-
Wellington St. W	- front	1260	820	-440
	- back	754	680	-74
Wellington St. W	- front	451	280	-171
	- back	609	575	-34
Wellington St. W	- front	544	495	-49
Wellington St. W	- back	640	260	-380
Wellington St. W	- back	(780)	(48)**	-
Wellington St. W	- front	449	405	-44
	- back	272	610	+338
Wellington St. W	- front	565	535	-30
Mean lead levels: (bracketed results excluded)		670	552	-118

* = Soil was replaced in 1976 - 77
** = Soil evidently replaced
*** = Sampling depth 0-15 cm (garden soils) in 1986

TABLE 3

Lead content of soil (0-2, 0-5 cm) collected at 17 locations in the vicinity of Toronto Refiners & Smelters - November, 1986

Station Number	Sample location/description	Depth (cm)	Lead Concentration (ppm-dry wt.)	
			Average	Replicate Results
1	Unpaved parking lot (coarse aggregate)	0-2	2,300	(2500 & 2100)
2	Unpaved parking lot, between railway tracks (coarse aggregate)	0-2	20,000	(20000 & 20000)
3	Unpaved parking lot	0-5	2,450	(1900 & 3000)
4	South end of Tecumseth (coarse aggregate)	0-2	1,700	(1900 & 1500)
5	Broken pavement E side of Tecumseth (coarse aggregate)	0-2	1,200	(1100 & 1300)
6	E side of Niagara St. (coarse aggregate)	0-2	1,100	(1100 & 1100)
7	N side of Niagara St. (coarse aggregate)	0-2	700	(720 & 680)
8	N side of Niagara St. (coarse aggregate)	0-2	420	(430 & 410)
9	N side of Wellington, E of stop sign on Niagara Street (coarse aggregate)	0-2	520	(440 & 600)
10	Parking lot E side of Tecumseth Street between Wellington & Niagara St. (coarse aggregate)	0-5 (near fence)	760	(700 & 820)
		0-2 (parking area)	82	(92 & 72)
11	Unpaved lane behind Wellington St.	0-5	320	(310 & 330)
12	Soil patch along Wellington St.	0-5	435	(490 & 380)
13	Between sidewalk and cinder block building, W side of Bathurst St. by light standard T30	0-5	9,350	(7700 & 11000)
14	Between sidewalk and chain link fence, W side Bathurst St. (coarse aggregate)	0-2	4,150	(4200 & 4100)
15	Vacant lot N side of Niagara Street (coarse aggregate)	0-2	515	(540 & 490)
16	Between sidewalk and chain link gate on N side of Niagara St. (coarse aggregate)	0-2	710	(680 & 740)
17	At base of trees beside sidewalk on S side of Niagara St. (coarse aggregate)	0-2	2,700	(3600 & 1800)

Notes: Station Nos. 4,5,6,7,8,11,12,13,14,15,16 & 17 appeared to be readily accessible to children.

A minimum of 10 cores were collected per sample and two replicate samples were taken at each station.

The arithmetic mean was calculated from the two values (replicate results bracketed) and that mean is reported as the concentration of lead in soil/aggregat at the sampled station.

Sampling locations were selected by Toronto Department of Public Health personnel. See Figure 2 for approx. locations relative to Toronto Refiners & Smelters.

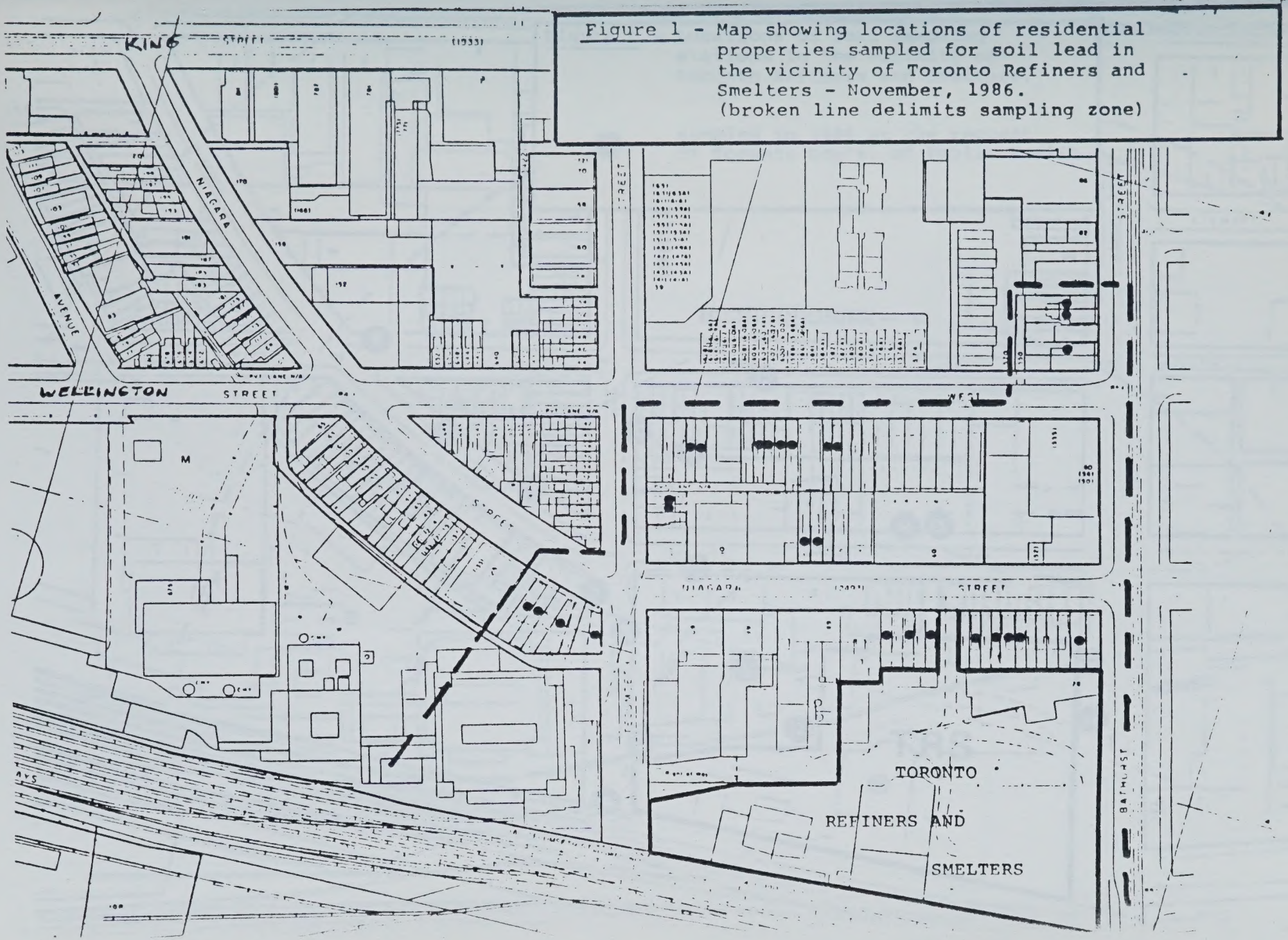

Figure 1 - Map showing locations of residential properties sampled for soil lead in the vicinity of Toronto Refiners and Smelters - November, 1986.
(broken line delimits sampling zone)

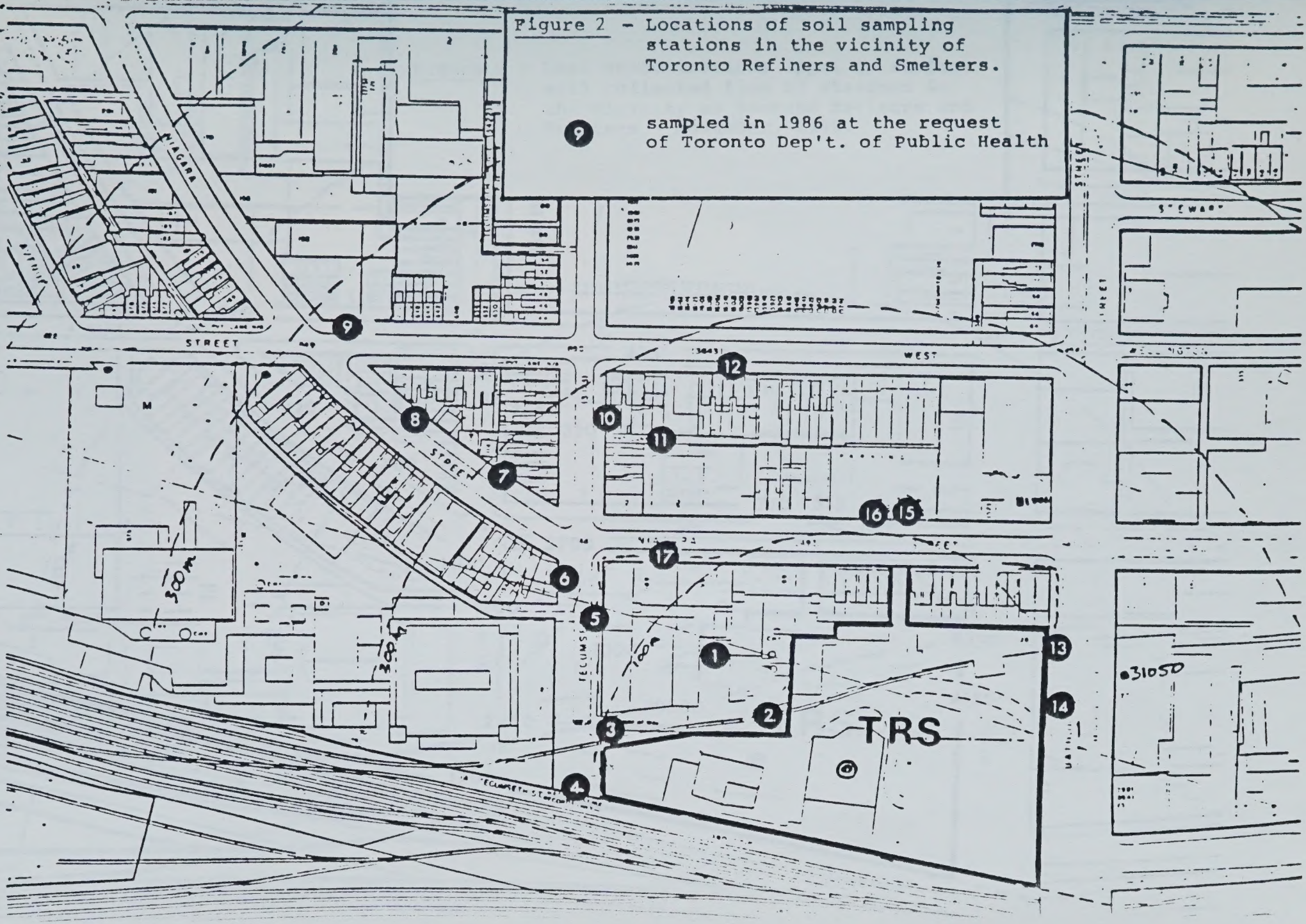
Figure 2 - Locations of soil sampling stations in the vicinity of Toronto Refiners and Smelters.
9 sampled in 1986 at the request of Toronto Dep't. of Public Health
NIAGARA STREET
WEST
TECUMSEH
STEWART
TRS
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

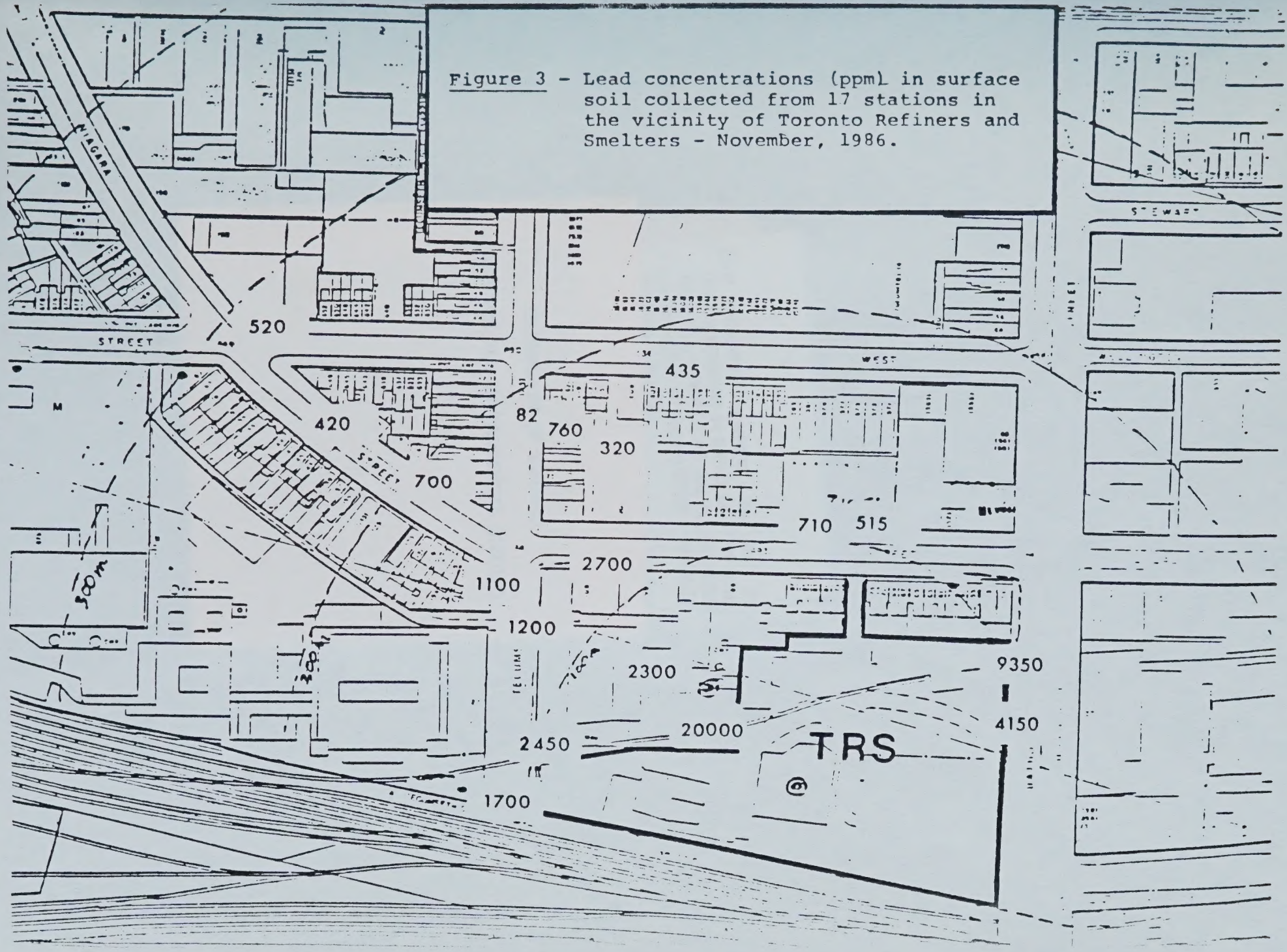

Figure 3 - Lead concentrations (ppm) in surface soil collected from 17 stations in the vicinity of Toronto Refiners and Smelters - November, 1986.

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